

**Virginia Electric and Power Company  
North Anna Power Station  
P. O. Box 402  
Mineral, Virginia 23117**

**October 20, 2011**

Attention: Document Control Desk  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Serial No.: 11-571  
NAPS: JHL  
Docket Nos.: 50-338, 339  
License Nos.: NPF-4, NPF-7

Dear Sirs:

Pursuant to 10CFR50.73, Virginia Electric and Power Company hereby submits the following Licensee Event Report applicable to North Anna Power Station Units 1 and 2.

Report No. 50-338/2011-003-00

This report has been reviewed by the Facility Safety Review Committee and will be forwarded to the Management Safety Review Committee for its review.

Sincerely,



N. Larry Lane  
Site Vice President  
North Anna Power Station

Enclosure

Commitments contained in this letter: None

cc: United States Nuclear Regulatory Commission  
Region II  
Marquis One Tower  
245 Peachtree Center Ave., NE, Suite 1200  
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector  
North Anna Power Station

IE22  
NRR

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto:infocollects.resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

## 1. FACILITY NAME

North Anna Power Station , Units 1 and 2

## 2. DOCKET NUMBER

05000 338

## 3. PAGE

1 OF 5

## 4. TITLE

Dual Unit Reactor Trip and ESF Actuations During Seismic Event With a Loss of Offsite Power

## 5. EVENT DATE

MONTH	DAY	YEAR
08	23	2011

## 6. LER NUMBER

YEAR	SEQUENTIAL NUMBER	REV NO.
2011	-- 003 --	00

## 7. REPORT DATE

MONTH	DAY	YEAR
10	20	2011

## 8. OTHER FACILITIES INVOLVED

FACILITY NAME	DOCUMENT NUMBER
North Anna Power Station	05000 339
FACILITY NAME	DOCUMENT NUMBER
	05000

## 9. OPERATING MODE

1

## 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

- |   |   |  |   |
|---|---|--|---|
| <input type="checkbox"/> 20.2201(b)         | <input type="checkbox"/> 20.2203(a)(3)(i)   | <input type="checkbox"/> 50.73(a)(2)(i)(C)             | <input type="checkbox"/> 50.73(a)(2)(vii)     |
| <input type="checkbox"/> 20.2201(d)         | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input type="checkbox"/> 50.73(a)(2)(ii)(A)            | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
| <input type="checkbox"/> 20.2203(a)(1)      | <input type="checkbox"/> 20.2203(a)(4)      | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i)   | <input type="checkbox"/> 50.36(c)(1)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(iii)              | <input type="checkbox"/> 50.73(a)(2)(ix)(A)   |
| <input type="checkbox"/> 20.2203(a)(2)(ii)  | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)       |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2)        | <input type="checkbox"/> 50.73(a)(2)(v)(A)             | <input type="checkbox"/> 73.71(a)(4)          |
| <input type="checkbox"/> 20.2203(a)(2)(iv)  | <input type="checkbox"/> 50.46(a)(3)(ii)    | <input type="checkbox"/> 50.73(a)(2)(v)(B)             | <input type="checkbox"/> 73.71(a)(5)          |
| <input type="checkbox"/> 20.2203(a)(2)(v)   | <input type="checkbox"/> 50.73(a)(2)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(v)(C)             | <input type="checkbox"/> OTHER                |
| <input type="checkbox"/> 20.2203(a)(2)(vi)  | <input type="checkbox"/> 50.73(a)(2)(i)(B)  | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)  |   |

Specify in Abstract below  
or in NRC Form 366A

## 12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

F. Mladen, Director Station Safety and Licensing

TELEPHONE NUMBER (Include Area Code)

(540) 894-2108

## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX
D	EK	DG	F010	Y					

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO15. EXPECTED  
SUBMISSION  
DATE

MONTH DAY YEAR

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On August 23, 2011, at 1351 hours, with both units in Mode 1 at 100% power, a magnitude 5.8 earthquake occurred approximately 11 miles WSW of North Anna Power Station. The earthquake caused an automatic reactor trip of both Units, and a loss of offsite power. At 1403 hours, an Alert was declared based on Shift Manager judgment, due to significant seismic activity onsite with the loss of offsite power. All Engineered Safety Feature equipment responded as designed with the exception of the Unit 1 turbine driven auxiliary feedwater pump, which was undergoing surveillance testing when the earthquake occurred. All 4 Emergency Diesel Generators (EDG) started as designed but the 2H EDG was manually tripped 49 minutes later due to a coolant system leak. The alternate AC diesel generator was subsequently aligned to re-energize the 2H emergency bus. Offsite power was fully restored at 2258 hours on August 23. This event is reportable per 10 CFR 50.73(a)(2)(iv)(A) for a condition that resulted in system actuations. On August 26, 2011, at 1623, a non-emergency 8-hour report was made to the NRC Operations Center, in accordance with 10CFR50.72(b)(3)(ii)(B) due to the seismic activity potentially exceeding design basis levels. It was later determined that the seismic activity did exceed design levels at some frequencies. The event posed no significant safety implications and the health and safety of the public were not affected by the event.

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## NARRATIVE

**1.0 DESCRIPTION OF THE EVENT**

On August 23, 2011, at 1351 hours, with Units 1 and 2 operating at 100 percent power, Mode 1, a magnitude 5.8 earthquake occurred approximately 11 miles WSW of North Anna Power Station. Ground motion was felt and recognized as an earthquake by the Main Control Room (MCR) operators. The earthquake caused a series of reactor trip signals to both Unit 1 and Unit 2 reactors, as well as a loss of offsite power to the station. The "First Out" reactor trip signals for both Units were "High Flux Rate Reactor Trip". The "First Out" turbine trip signal for Unit 1 was "Main Transformer Lock Out". The "First Out" turbine trip signal for Unit 2 was "Reactor Trip/Turbine Trip". The earthquake caused multiple transformers (EIS Component XFMR) to lock out due to activation of the sudden pressure relays (EIS Component RLY) resulting in the loss of offsite power. It was subsequently determined that the sudden pressure relays operated as designed as a result of the earthquake induced pressure pulse; no electrical fault occurred. During the seismic event, no alarms were received on the Seismic Monitoring Instrumentation Panel (EIS System IN) in the MCR. This was caused by the momentary loss of semi-vital power (EIS System ED) to the Seismic Monitoring Instrumentation Panel as a result of the loss of offsite power and EDG start and load timing.

At 1403 hours, an Alert emergency classification was declared under Emergency Action Level (EAL) HA-6.1, based on Shift Manager judgment, due to significant seismic activity on the site and loss of offsite power.

The station response to the event focused on stabilizing the Units and restoring power to affected busses. The control room teams responded to the reactor trips in accordance with procedures 1 and 2-E-0, Reactor Trip or Safety Injection and transitioned to 1 and 2-ES-0.1, Reactor Trip Response. In addition to stabilizing the units in accordance with 1 and 2-ES-0.1, Reactor Trip Response, several additional operating and abnormal procedures were used to deal with plant conditions concurrently with emergency procedures.

All Engineered Safety Feature (ESF) equipment (EIS System JE) responded as designed with the exception of the Unit 1 turbine driven auxiliary feedwater (TDAFW) pump (EIS System BA, Component P) because it was undergoing surveillance testing when the Unit 1 reactor trip occurred. At approximately 1424 hours, the TDAFW pump was manually realigned and was capable of injecting water to the "A" steam generator (EIS System AB, Component HX). The motor-driven AFW pumps started and responded as expected during the event. An additional charging pump (EIS System BI, Component P) for each unit, and service water pumps (EIS System BI, Component P) that were not running, started when the emergency diesel generators (EDGs) (EIS System EK, Component DG) automatically started due to the loss of offsite power.

The EDGs automatically started due to the loss of offsite power and re-energized the emergency busses. Forty-nine minutes into the event, the Unit 2 "H" (2H) EDG was manually tripped due to a coolant system leak (EIS System LB). At 1455 hours, a second Alert emergency classification was declared per EAL SA-1.1 due to the Unit 2 "H" emergency

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bus being out of service and the Unit 2 "J" bus having only one power source for greater than 15 minutes. At 1527 hours, the alternate AC diesel generator (EIS Component DG) was aligned to feed the 2 "H" emergency bus. At 2055 hours, following restoration of each of the Reserve Station Service Transformers (EIS System EA, Component XFMR), the NRC was notified that all emergency busses were powered from offsite power. At 2138 hours, the EDGs and the alternate AC diesel generator were shut down.

On August 24, 2011, at 0851, a Unit 1 RCS cool down to Cold Shutdown commenced. The Unit 2 cool down to Cold Shutdown commenced following the Unit 1 cool down. On August 24, 2011, at 1116 hours, the Alert emergency classification was downgraded to a Notification of Unusual Event (NOUE). The NOUE was terminated at 1315 hours on August 24, 2011 after completing walkdowns and inspections in accordance with plant abnormal procedures.

On August 26, 2011, at 1623, a non-emergency 8-hour report was made to the NRC Operations Center, in accordance with 10 CFR 50.72(b)(3)(ii)(B) because initial reviews of the seismic data determined that the seismic acceleration potentially exceeded the Design Basis Earthquake magnitude value at frequencies above 5 Hertz. On September 9, 2011, at 1739 hours, a notification update was made to the NRC Operations Center indicating that based on the evaluation of recorded seismic instrumentation data, it was concluded that the Central Virginia earthquake on August 23, 2011 exceeded the spectral accelerations for the Operating Basis Earthquake (OBE) and Design Basis Earthquake (DBE) for North Anna Power Station. This event was reported pursuant to 10 CFR 50.73(a)(2)(ii)(B) for the nuclear power plant being in an unanalyzed condition that significantly degrades plant safety.

In addition, the event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) for a condition that resulted in automation actuation of the Reactor Protection System, Auxiliary Feedwater System, Charging System, Service Water System, and Emergency Diesel Generators for North Anna Units 1 and 2. As a result of the loss of offsite power the event is also reportable under 10 CFR 50.73(a)(2)(v)(D) for a condition that could have prevented the fulfillment of the safety function of systems that are needed to mitigate the consequences of an accident.

**2.0 SIGNIFICANT SAFETY CONSEQUENCES AND IMPLICATIONS**

The reactivity excursion was postulated to have occurred due to synergistic effects of the seismic event. Core motion induced reactivity changes resulted in a net negative reactivity addition and observed power decrease followed by a net positive reactivity addition and observed power increase. The power increase on Unit 1 was observed to peak and turn downward without rod motion, on Unit 2 the positive peak was arrested by the control rod motion. At no time did indicated reactor power increase above 100% following the initial decrease in power. There were no safety consequences as a result of this event and the reactor was shut down as a result of a negative flux rate trip. All ESF equipment responded as designed with the exception of the Unit 1 turbine driven auxiliary feedwater pump, which was undergoing surveillance testing when the earthquake occurred. .

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The Plant Computer System (EIS System ID) data was reviewed relative to the requirements of the North Anna UFSAR safety analyses. Based on a review of this data, the global RCS response is consistent with a normal reactor trip from full power followed by an RCP trip coast down from the loss of power to the supply busses. Although there are some core power variations prior to full control rod insertion, power decreased from the initial value and at no time exceeded 100 percent power. RCS temperatures trended smoothly toward hot zero power values as expected with no perturbations.

Safety analysis events most applicable to this event are included in UFSAR Sections 15.2.7 "Loss of External Electrical Load and/or Turbine Trip" (LOEL), 15.2.9 "Loss of Offsite Power to the Station Auxiliaries" (LOOP), and 15.3.4 "Complete Loss of Reactor Coolant Flow" (CLOF). Since the reactor trip, turbine trip and reactor coolant pump trips occurred at essentially the same time during the plant event, the transient response was bounded by the safety analysis response for these events. In particular, safety analysis requirements relative to core cooling/DNB criteria, RCS and main steam pressure, and pressurizer level were met. It is also noted that the LOEL, which demonstrates long-term core cooling, only credits operation of the motor-operated AFW pumps and therefore bounds the planned unavailability of the turbine-driven AFW pump.

The reactor trips were bounded by the North Anna UFSAR safety analyses. The integrity of the core was maintained by operation of the Reactor Protection System and natural circulation flow through the RCS loops and reactor core. In addition, pressure relief valves and sprays maintained primary and secondary pressures well below safety analysis allowable values.

During the event, the 2H EDG developed a coolant leak and was manually tripped. The alternate AC diesel generator was aligned to the 2H emergency bus. The 2H EDG coolant leak is being reported in LER N2-2011-001-00.

**3.0 CAUSE**

The Direct Cause for the both the Unit 1 and Unit 2 reactor trip was the initiation of the Nuclear Instrument (NIs) Power (PWR) Range Hi Flux Rate Reactor Trip. Both Unit 1 and Unit 2 met the required coincidence of 2 out of 4 Power Range Nuclear Instruments (PRNI) with greater than a 5 percent change in 2.25 seconds.

The Root Cause of this event was a synergistic combination of seismically induced conditions which include core barrel movement, detector movement, and small reactivity effects from core movement and thickening of the thermal-boundary layer along the fuel rods. The additive effects of the combined conditions resulted in momentary under moderated core conditions as evidenced by the oscillatory but overall decreasing flux profiles from both Unit 1 and Unit 2.

The cause of the 2 "H" EDG coolant leak will be addressed in LER N2-2011-001-00.

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**4.0 IMMEDIATE CORRECTIVE ACTION(S)**

The initial station response to the dual unit reactor trip stabilized the Units and restored power to affected busses. The control room teams responded to the reactor trips in accordance with procedures 1 and 2-E-0, Reactor Trip or Safety Injection and the transition to 1-ES-0.1/2-ES-0.1, Reactor Trip Response occurred appropriately. In addition to stabilizing the Reactor Plants in 1-ES-0.1 and 2-ES-0.1, Reactor Trip Response, several additional abnormal procedures were used to address plant conditions.

**5.0 ADDITIONAL CORRECTIVE ACTIONS**

Once immediate corrective actions were performed, plant walkdowns and inspections were conducted. These inspections did not identify any significant physical or functional damage to safety-related plant systems, structures and components (SSC) and only limited damage to non-safety related, non-seismically designed SSCs.

Compensatory and short term corrective actions and enhancements identified in the root cause evaluation associated with the dual unit reactor trip are being tracked in the Corrective Action Program. Dominion letters dated September 17, 2011 (Serial No. 11-520) and September 27, 2011 (Serial No. 11-520A) provide a summary report (and update) of the response and near-term actions associated with the August 23, 2011 earthquake.

An uninterruptable power supply (UPS) was installed for the Seismic Monitoring Instrumentation Panel in the main control room.

Corrective actions associated with the 2H EDG will be addressed in LER N2-2011-001-00.

**6.0 ACTIONS TO PREVENT RECURRENCE**

It has been verified that the August 23, 2011 seismic event exceeded the North Anna Power Station Design Basis Earthquake (DBE) limits. After thorough investigation, station systems causing the Power Range High Flux Reactor Trip actuated as expected and desired. Therefore, it is neither desired nor necessary to pursue corrective action to prevent recurrence for the reactor trip that occurred as a result of the seismic event.

**7.0 SIMILAR EVENTS**

There have been no similar events at North Anna.

**8.0 ADDITIONAL INFORMATION**

None